```
/PAL III
/PART IV
/PAGE 28
/ASR 33 I/O ROUTINES
/CALLED BY JMS I AAA
/EXITS WITH LEGAL CHARACTER IN CHAR
/LENGTH:  14 REGISTERS
*1400

LOREAD, 0
        KSF
        JMP .-1
        KRB             /READ THE CHARACTER
        SNA             /BLANK TAPE?
        JMP LOREAD+1    /IGNORE
        TAD M200                /LEADER?
        SNA
        JMP LOREAD+1    /IGNORE
        TAD C200
        DCA CHAR                /SAVE CHAR
        JMS I CHEKI     /IS IT LEGAL?
        JMP LOREAD+1    /NO, TRY AGAIN
        JMP I LOREAD

/ROUTINE TO SET SIGN FOR
/ADD OR SUBTRACT OR IOR
/LENGTH: 8 REGISTERS
SUB,    TAD M2          /SIGN FOR SUBTRACT IS -1
ADD,    IAC             /SIGN FOR ADD IS +1
SPACE,  DCA TEM2                /SIGN FOR IOR IS 0
        PUSHJ           /GO PROCESS THE INFORMATION
        SPAC            /ADDRESS
        TAD TEM2
        DCA SIGN                /SET SIGN
        JMP I FFF       /GO BACK TO CSYM
```

```
/PAGE 29
/PAL 750 READ ROUTINE
/CALLED BY JMS I AAA
/EXITS WITH LEGAL CHARACTER IN CHAR
/LENGTH: 48 REGISTERS

HIREAD, 0
        ISZ RCNT                /IS BUFFER EMPTY?
        JMP GETCHR      /NO, FETCH A CHARACTER
        ISZ SWITCH      /DID TAPE END?
        SKP             /NO
        JMP ENDBF       /YES, GO HALT
        DCA SWITCH      /SET SWITCH AGAIN
        TAD RBGN                /POINTER TO BEGINNING OF BUFFER
        DCA AUTOA       /IN AN AUTO-INDEX REGISTER
        TAD RKON                /CONSTANT FOR SIZE OF BUFFER
        DCA RCNT                /IN READ COUNTER
READIN, RFC             /FETCH A CHARACTER
        DCA TEM3                /START COUNTING
        ISZ TEM3                /OVERFLOW?
        JMS WAIT
        JMP FULL1       /YES, SET SWITCH, TAPE ENDED
        RSF             /CHARACTER READY YET?
        JMP .-4                 /NO, TRY AGAIN
        RRB
        SNA             /IS IT BLANK TAPE?
        JMP READIN      /IGNORE BLANK TAPE
        TAD M200                /IS IT LEADER-TRAILER?
        SNA
        JMP READIN      /IGNORE LEADER-TRAILER
        TAD C200                /RESTORE ORIGINAL CODE
        DCA I AUTOA     /SAVE IT
        ISZ RCNT                /BUFFER FULL YET?
        JMP READIN      /NO, GET SOME MORE
        JMP FULL                /FULL
FULL1,  CLA CMA                 /SET TAPE SWITCH TO 7777
        DCA SWITCH
        TAD RCNT                /GET ALTERED COUNT FOR BUFFER
        CMA IAC
FULL,   TAD RKON
        SNA             /WAS BUFFER COMPLETELY EMPTY?
        JMP ENDBF       /YES
        DCA RCNT                /NO, COUNT OF BUFFER SIZE
        TAD RBGN                /RESET BUFFER POINTER
        DCA AUTOB
GETCHR, TAD I AUTOB     /GET A CHARACTER FROM BUFFER
        DCA CHAR
        JMS I CHEKI     /IS IT LEGAL?
        JMP HIREAD+1    /NO
        JMP I HIREAD    /YES
ENDBF,  CLA CMA                 /SET COUNT TO EMPTY
        DCA RCNT
        HLT             /HALT
        JMP HIREAD+1    /TRY AGAIN
```

```
/PAGE 30
/CHECK FOR SPECIAL CHARACTERS IN READ ROUTINES
/EXIT TO CALLING ADDRESS+1 IF CHAR IS TO BE IGNORED
/EXIT TO CALLING ADDRESS+2 IF CHAR IS LEGAL
/THE FOLLOWING CHARACTERS ARE IGNORED:
/  0        BLANK TAPE
/200        LEADER-TRAILER
/212        LINE FEED
/214        FORM FEED
/377        RUBOUT

/LENGTH: 40 REGISTERS

CHEK,   0
        TAD CHAR
        AND SL7             /SET CHANNEL 8
        TAD C200                    /IN CASE OF PARITY
        DCA CHAR                    /INPUT
        TAD CHAR
        TAD M377                    /IGNORE RUBOUT
        SNA CLA
        JMP I CHEK
        TAD PF              /PASS 3?
        SMA CLA
        JMP .+3
        TAD CHAR                    /GET CHARACTER
        DCA I AUTOC         /STORE IN PASS3 BUFFER
        TAD CHAR                    /CHECK FOR A COMMENT
        TAD M215                    /CARRIAGE RETURN?
        SNA CLA
        JMP ECMN                    /YES, END OF COMMENT
        TAD FLAG                    /NO, ARE WE PRESENTLY IN A COMENT?
        SZA CLA
        JMP I CHEK          /YES, IGNORE THE CHARACTER
        TAD CHAR
        TAD M212                    /LINE FEED?
        SNA
        JMP I CHEK          /YES, IGNORE LINE FEED
        TAD M2              /FORM FEED?
        SNA
        JMP I CHEK          /YES, IGNORE FORM FEED
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          TAD M43A                    /IS IT A SLASH??
          SNA CLA
          JMP COMMNT                  /YES: START OF COMMENT
          ISZ CHEK                    /NO, LEGAL CHARACTER
          JMP I CHEK        /EXIT

COMMNT,   ISZ FLAG                    /BEGINNING OF COMMENT
          JMP I CHEK        /SET FLAG TO ZERO, EXIT
ECMN,     DCA FLAG                    /END OF COMMENT
          ISZ CHEK                    /GET CHARACTER
          JMP I CHEK        /EXIT

M43A,     -0043
M377,     -0377

/THE EXPUNGE PSEUDO-OP
/LENGTH: 13 REGISTERS

EXPN,     DCA INFO                    /NO PUNCHING
          TAD PF            /WHICH PASS IS THIS?
          SZA CLA           /IGNORE IT ON PASS 2 OR 3
          POPJ              /EXIT
          CMA               /MOVE SYMBOL TABLE BACK
          TAD MCRI                    /TO PSEUDO-OPS
          DCA IAM1
          TAD IAM1
          DCA SPNT
          DCA I MCRIP
          POPJ              /EXIT

MCRI,     OPCD
MCRIP,    MICRP

L14,
```

```
*1600
/PAGE 32
/ERROR ROUTINES FOR PAL III
/LENGTH: 45 REGISTERS

/THE ERROR ROUTINES ARE OF TWO TYPES
/ TYPE 1 CONSISTS OF
/       UA   UNDEFINED ADDRESS
/       DT   DOUBLE TAG
/       ST   SYMBOL TABLE OVERFLOW
/       RD   REDEFINITION BY PARAMETER ASSIGN.
/ TYPE 1 ERRORS ARE CALLED BY
/       PUSHJ
/       ERROR1

/WITH THE ADDRESS OF THE OFFFENDING SYMBOL ON THE PUSHDOWN LIST
/AND WITH THE CODE FOR THE ERROR IN C(AC)
/THE ERROR PRINTOUT IS
/ XX YYYYYY AT ZZZZ
/WHERE XX REPRESENTS THE PARTICULAR ERROR CODE INVOLVED
/YYYYYY REPRESENTS THE SYMBOL THAT CAUSED THE ERROR
/ZZZZ REPRESENTS THE LOCATION IN THE USER'S PROGRAM AT WHICH THE
/ERROR OCCURRED

/TYPE 2 ERRORS CONSIST OF
/      IC   ILLEGAL CHARACTER
/      IR   ILLEGAL REFERENCE
/      PO   PUSHDOWN OVERFLOW
/      PU   PUSHDOWN UNDERFLOW
/TYPE 2 ERRORS ARE CALLED BY
/      PUSHJ
/      ERROR2
/WITH THE VALUE OF THE ILLEGAL CHARACTER, LITERAL, OR ORIGIN ON THE
/PUSHDOWN LIST AND THE CODE FOR THE ERROR IN THE ACCUMULATOR
/THE ERROR PRINTOUT IS
/XX YYYY AT ZZZZ
/WHERE XX REPRESENTS THE PARTICULAR ERROR CODE INVOLVED
/YYYY REPRESENTS THE VALUE OF THE ILLEGAL CHARACTER OR REFERENCE
/ZZZZ REPRESENTS THE LOCATION IN THE USER'S PROGRAM AT WHICH THE ERROR
/ OCCURRED

/NUMBER CODE FOR ERRORS
/1          UA
/2          DT
/3          ST
/4          IC
/5          IR
/6          PO
/7          PU
/10         RD
```

```
/PAGE 33
ERROR1, JMS ETYPO       /TYPE ERROR CODE
        DCA TEM2                /SAVE SYMBOL ADDRESS AS A POINTER
        TAD I TEM2      /GET FIRST WORD OF SYMBOL
        AND MASK                /GET RID OF UNDEFINED BIT
        DCA I TEM2      /SYMBOL IS DEFINED FOR FUTURE REFERENCE
        TAD I TEM2      /GET IT BACK IN THE AC
        JMS I EEE       /TYPE OUT THE FIRST WORD OF THE SYMBOL
        ISZ TEM2                /INCREMENT THE POINTER TO THE 2ND WORD
        TAD I TEM2      /PICK UP THE 2ND WORD
        JMS I EEE       /TYPE IT OUT
        ISZ TEM2                /MOVE THE POINTER TO THE THIRD WORD
        TAD I TEM2      /PICK UP THE THIRD WORD
        JMS I EEE       /TYPE IT OUT
ECOMON, JMS I EEE       /TYPE TWO SPACES
        TAD ATCODE      /GET "AT"
        JMS I EEE       /TYPE IT
        JMS I EEE       /TYPE TWO SPACES
        TAD AACT                /GET THE ABSOLUTE ADDRESS COUNTER
        JMS I OCTI      /TYPE IT OUT
        TAD C377                /TYPE A RUBOUT
        JMS I DDD
        JMP I TEM1      /EXIT

ERROR2, JMS ETYPO       /TYPE THE ERROR CODE
        JMS I OCTI      /TYPE THE VALUE OF IC, PO, OR PU
        JMP ECOMON      /TYPE "AT" AND AACT

ETYPO,  0               /SUBROUTINE TO TYPE ERROR CODE
        TAD TBLEAD      /ADD ERROR CODE TO TABLE POINTER
        DCA TEM2                /SAVE POINTER TO CODE IN TEMP
        POP             /GET EXIT ADDRESS FROM PDL
        DCA TEM1                /SAVE IT, ERROR ADDRESS NOW AVAILABLE
        TAD PF          /WHICH PASS IS THIS?
        SZA CLA                 /ERROR PRINTOUTS ONLY ON PASS1
        JMP ERROUT      /OTHERWISE, EXIT FROM ERROR ROUTINE
        TAD C377                /TYPE A RUBOUT IN CASE OF IR
        JMS I DDD
        TAD CRLF                /TYPE A CARRIAGE RETURN, LINE FEED
        JMS I EEE
        TAD I TEM2      /GET THE ERROR CODE LETTERS
        JMS I EEE       /TYPE THE ERROR CODE
        JMS I EEE       /TYPE TWO SPACES
        POP             /GET SYMBOL ADDRESS OR IC, IL, IO VALUE
        JMP I ETYPO     /EXIT WITH IT IN THE AC

ERROUT, POP             /CLEAR JUNK OFF THE PUSHDOWN LIST
        CLA
        JMP I TEM1      /EXIT
```

```
/PAGE 34
/PASS3 ROUTINE
/ASSEMBLY LISTING ON ASR33 IF SW11 DOWN, 75A IF UP
/LENGTH: 75 REGISTERS

POUT,   CLA OSR                 /GET SWITCH REGISTER
        CLL RAR                 /WAS BIT 11 SET?
        SNL CLA
        JMP PART1       /NO
        TAD BBB                 /YES, RESET PRINT POINTER
        DCA DDD                 /FOR 75A PUNCH
PART1,  TAD CRLF                /TYPE CR, LF
        JMS I EEE
        TAD INFO                /ANY INFORMATION ON THIS LINE?
        SZA CLA
        JMP PART2       /YES
        TAD M6          /NO, TYPE 12 SPACES
        DCA TEM3
        JMS I EEE
        ISZ TEM3
        JMP .-2
        JMP .+7                 /DON'T TYPE AACT
PART2,  TAD AACT                /VALID INFO, TYPE AACT
        JMS I OCTI
        JMS I EEE       /TYPE 2 SPACES
        TAD BINW                /TYPE ASSEMBLED VALUE
        JMS I OCTI
        JMS I EEE       /TYPE TWO SPACES
        TAD CHAR                /WAS IT A CR?
        TAD M215
        SZA CLA
        JMP I TABIT-1   /NO: RETURN
        CLA CMA                 /YES: PUT STATEMENT
        DCA I AUTOC     /DELIMITER IN BUFFER
PART3,  TAD TBUF                /SET BUFFER
        DCA AUTOC
PART4,  TAD I AUTOC     /GET CHARACTER
        TAD M211                /TAB?
        SNA
        JMP TABIT       /YES, TYPE TAB, RUBOUT
        TAD M1          /LINE FEED?
        SNA
        JMP PART4       /YES, IGNORE IT
        TAD M2          /FORM FEED?
        SNA
        JMP FFEED       /YES, TYPE FORM FEED
        TAD M1          /CARRIAGE RETURN?
        SNA
        JMP PART4       /YES, IGNORE IT
        TAD C215                /RESTORE ORIGINAL CHARACTER
        SPA             /RUBOUT?
        JMP PART5       /YES, ALL DONE
        SZA             /IGNORE CR
        JMS I DDD       /NO, TYPE OR PUNCH CHAR
        JMP PART4       /RETURN
```

```
/PAGE 35
PART5,  CLA                     /ALL DONE
        TAD TBUF                        /RESET BUFFER
        DCA AUTOC
        TAD LOPUNI      /RESET PUNCH POINTER
        DCA DDD
        JMP I .+1
        MQUT                    /RETURN TO MAIN
TABIT,  TAD C211                        /TAB ROUTINE
        JMS I DDD
        TAD C377                        /TYPE RUBOUT
        JMS I DDD
JMP PART4       /RETUUN

FFEEEED,        TAD M6                  /TYPE SIX BLANK LINES
        DCA TEM3
        MS I DDD
        ISZ TEM3
        JMP .-2
        TAD C214                        /TYPE FORM FEED
        JMS I DDD
        TAD M6                  /TYPE SIX MORE BLANK LINES
        DCA TEM3
        JMS I DDD
        ISZ TEM3
        JMP .-2
        JMP PART4               /RETURN

TBLEAD, TABLE-1                 /POINTER FOR ERROR CODES
ATCODE, 01244                   /AT

/SET INDIRECT BIT
INDI,   TAD C400                        /"I"= 0400
        DCA SYMVAL
        ISZ INFO                        /I= VALID INFORMATION
        POPJ                    /RETURN

L16,

        PAUS
```